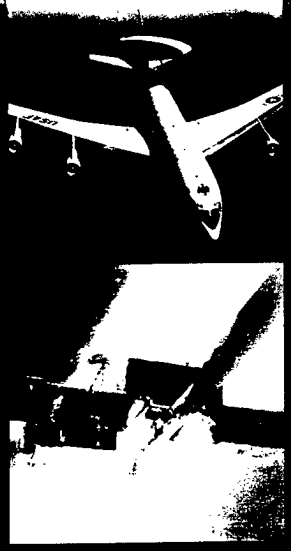
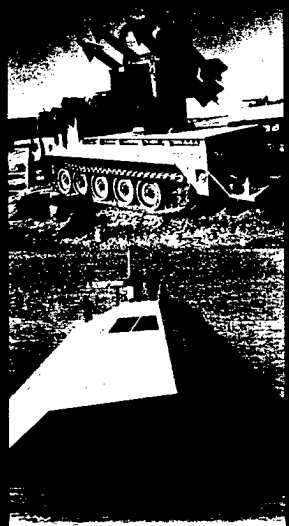




# Joint Spectrum Vision 2010

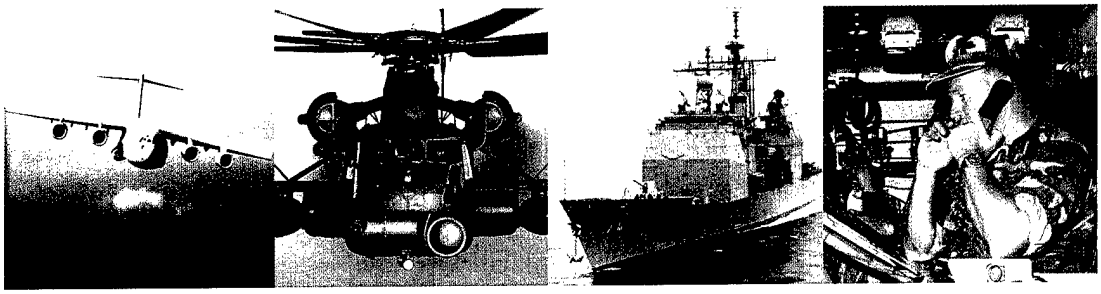


Current and future warfighting capabilities of the Department of Defense (DoD) depend on access to the electromagnetic spectrum. To meet this critical need for spectrum, the DoD must have a strategy aimed at sustaining and potentially expanding access to the electromagnetic spectrum, as we face the evolving national defense responsibilities of the future. There are significant challenges to maintaining sufficient spectrum access to adequately support our warfighters. These challenges include competition for spectrum with commercial industry in the global arena, growth in the use of spectrum-dependent technologies on the battlefield, and national and international regulatory developments.

The DoD has developed a guiding vision for pro-actively pursuing spectrum initiatives on many fronts to ensure spectrum access is available when and where needed. Our spectrum vision is not a status quo approach. It necessarily emphasizes the need for intensive engagement with the acquisition community, new operational management concepts and processes, and continuous leveraging of advanced spectrum technologies. The DoD's pursuit of these initiatives will enable us to wisely and effectively ensure that the electromagnetic spectrum is accessible to our warfighting forces and their weapons systems. *Joint Spectrum Vision 2010* provides a coherent view of the mid-term and long-term spectrum implications of realizing this vision. Together we will overcome the challenges, technological and otherwise, necessary to ensure that our warfighters have access to sufficient electromagnetic spectrum.

JOHN L. WOODWARD, JR.
Lieutenant General, USAF
Director for Command, Control,
Communications and Computer Systems

# Contents



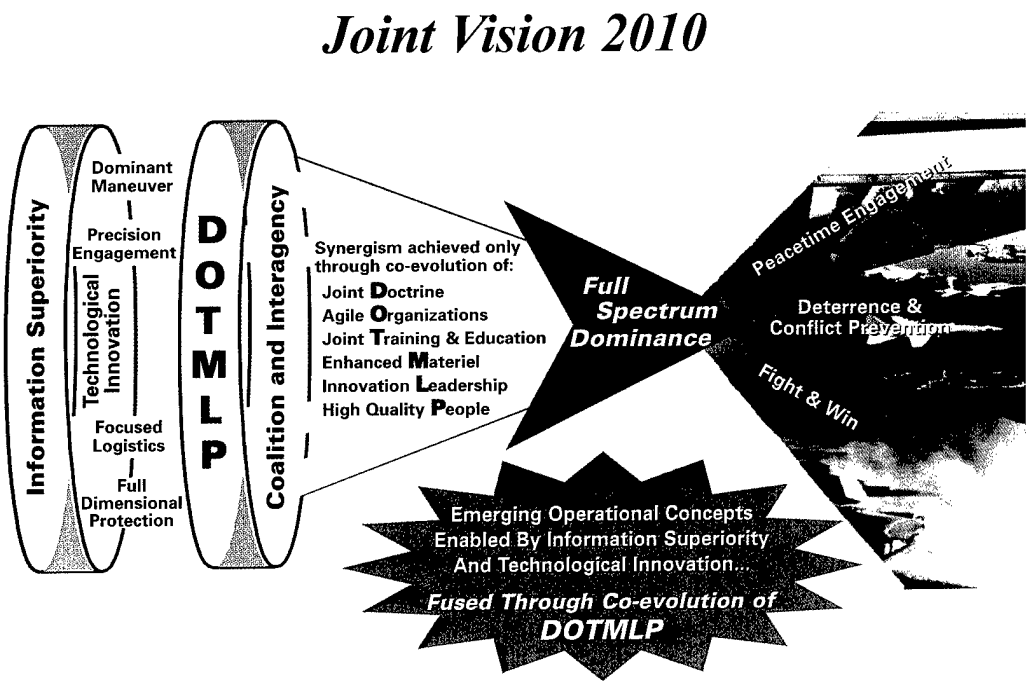
# Introduction

*Joint Spectrum Vision 2010* (JSV 2010) outlines the conceptual framework for how the Department of Defense (DoD) will assure the availability of and access to sufficient electromagnetic spectrum for the United States (US) Armed Forces to achieve new levels of effectiveness in joint warfighting, as prescribed in *Joint Vision 2010* (JV 2010).[1] The implementation of JSV 2010 will involve the Office of the Secretary of Defense (OSD) staff, the Commanders in Chief (CINCs), Services, Defense Agencies, and Joint organizations, as well as the tactical frequency managers on the operational front; collectively, these compose the Joint Spectrum Management Team. JSV 2010 provides a coherent view of the mid-term and long-term spectrum implications of realizing JV 2010 and addresses how the Joint Spectrum Management Team is structured to carry out the actions necessary to provide assured, sufficient electromagnetic spectrum access to the US Armed Forces of the 21st century, enabling them to achieve Full Spectrum Dominance in warfighting.

JV 2010 addresses the changes being implemented to bring US Armed Forces into the 21st century. It describes the improved command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) capabilities that must be available to US Armed Forces in the Information Age. JV 2010 presents four operational concepts for achieving Information Superiority: Dominant Maneuver, Precision Engagement, Focused Logistics, and Full-Dimensional Protection. Each of these operational concepts relies heavily on the leveraging of Information Age technological advances so that US Joint Forces may achieve the level of Information Superiority needed to ensure dominance over potential opponents across the full range of military operations. JV 2010 also illustrates that the continued, timely insertion of advanced technologies into weapons systems is a key enabler of Full Spectrum Dominance. System-of-systems capabilities will rely on Information Superiority for complete battlespace awareness and real-time situational awareness, which are prerequisites for the dramatically increased warfighting effectiveness demanded by JV 2010.

[1] *Joint Vision 2010,* Washington, DC: Chairman of the Joint Chiefs of Staff.

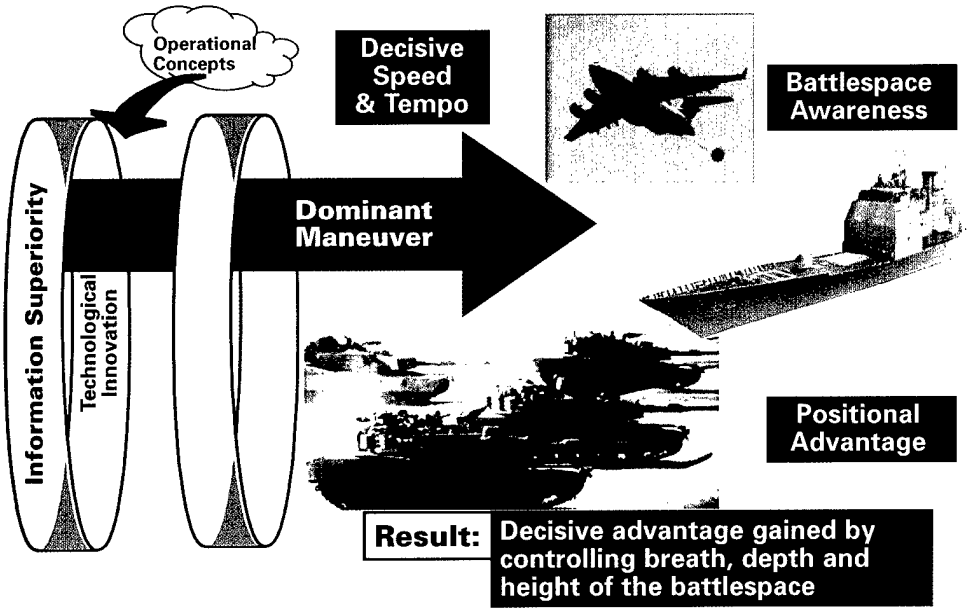
The enabling power of Information Superiority in realizing the JV 2010 operational concepts is illustrated in the following figure. The four JV 2010 operational concepts are each highly dependent on assured, available electromagnetic spectrum. As the DoD actualizes these JV 2010 concepts, access to the electromagnetic spectrum must become more agile, adaptive, and efficient than legacy technologies, systems, and practices allow — in order to provide a seamless, interoperable, integrated, robust, and instantly responsive information grid to the warfighter.



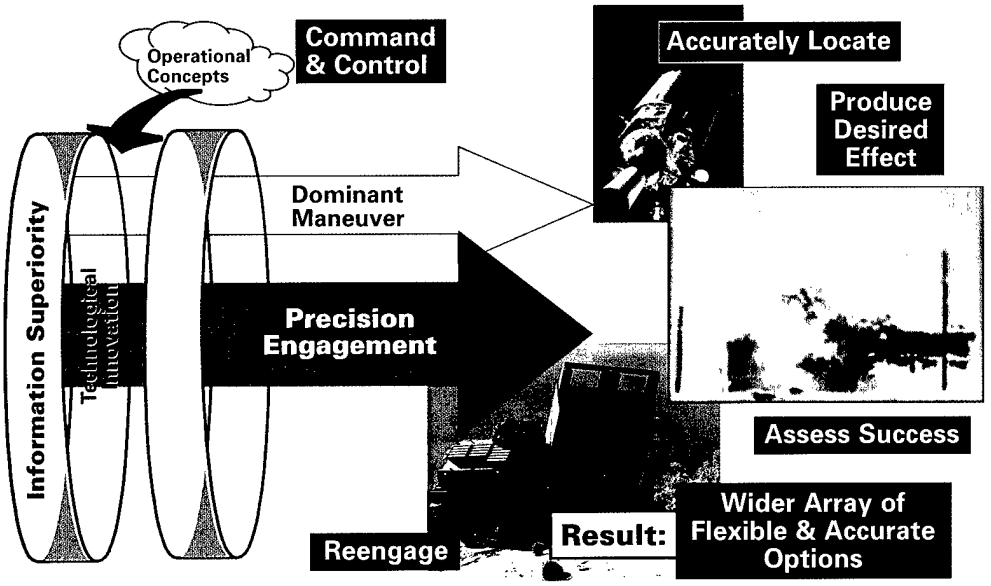

## The Changing Battlespace Environment

The four operational concepts at the heart of JV 2010, illustrated in the following figures, will enable US warfighters to dominate the full range of military operations from humanitarian assistance, through peace operations, up to and including high-intensity conflict. Information Superiority will be critical in supporting these concepts and in providing commanders with the enhanced battlespace awareness needed to successfully complete all missions.

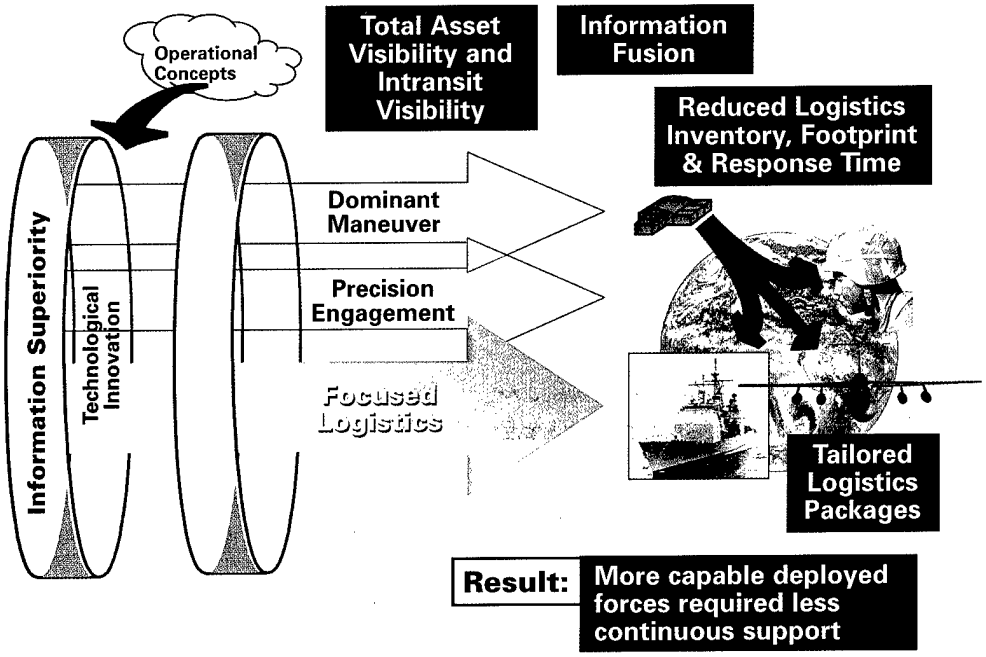
# *Dominant Maneuver*



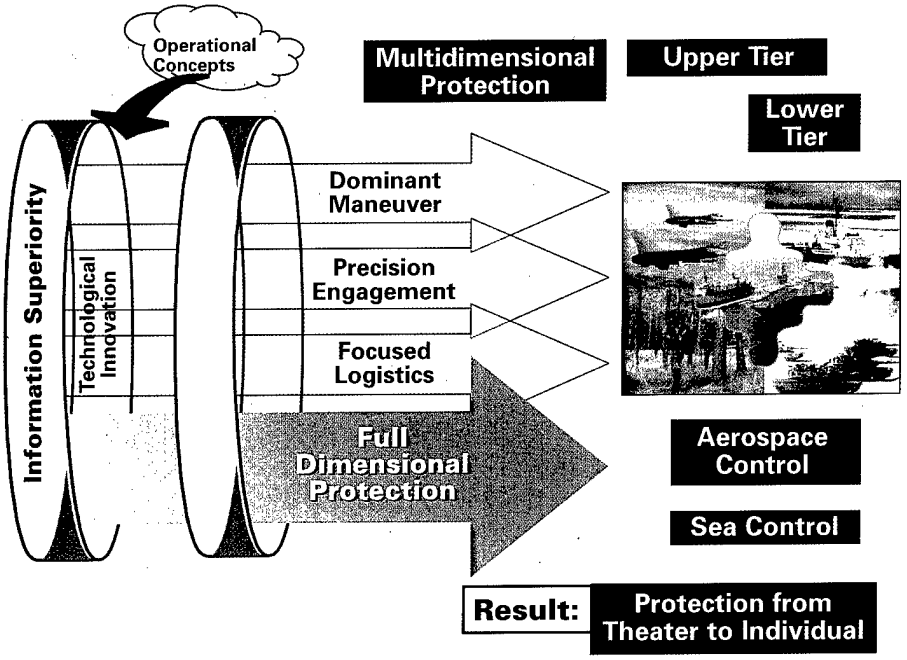

# *Precision Engagement*



# *Focused Logistics*

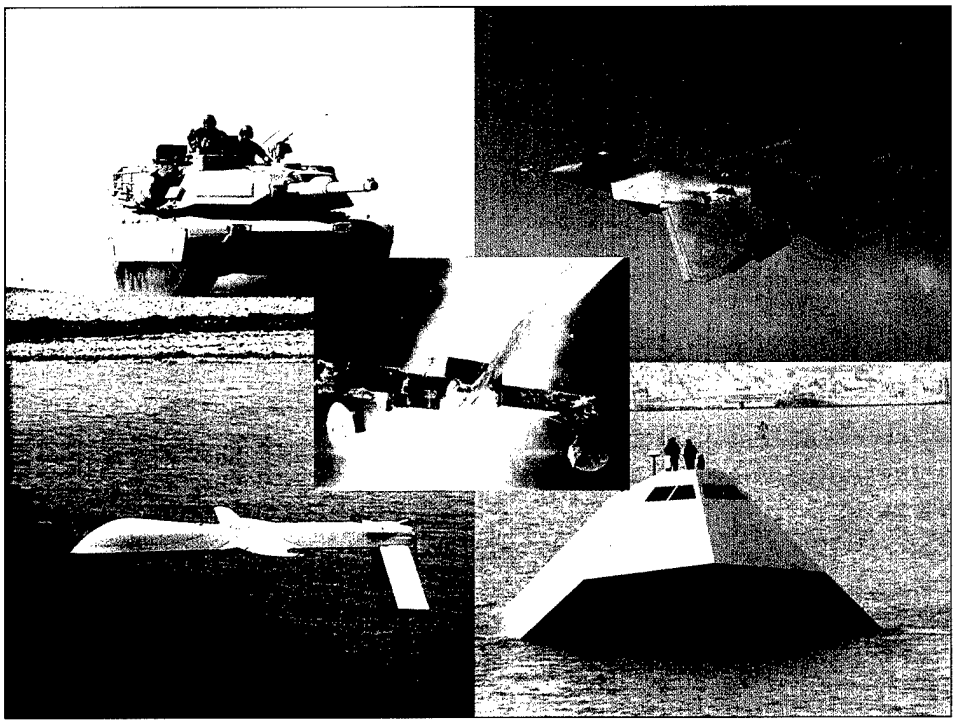



# *Full-Dimensional Protection*



Global changes in weapons systems, information technologies, and political landscapes make the future of the battlespace environment more uncertain for US Armed Forces in the 21st century. Despite these changes, US forces will still be expected to win against any opponent in an engagement, while becoming more efficient in protecting both personnel and material resources. US forces will also be required to operate more effectively in Joint — Army, Navy, Air Force, Marines — engagements and with allied and coalition partners. The enabling technologies that will provide for successful operations in this changing battlespace environment include

- Long-range precision weapons with a wide range of delivery systems
- Broader range of weapons effects
- Advanced low-observable technologies
- Advanced information systems



**Enabling Technologies**

These technologies will permit order-of-magnitude improvements in lethality by enhancing the accuracy and precision of information provided to the warfighter while also enhancing the accuracy of weapon systems and the survivability of forces. As a result, US forces will be able to conduct discrete, lethal attacks on selected targets with reduced risk and with high probability of success using fewer platforms and ordnance. Equipping warfighters with improved detection, targeting, and communications equipment will allow for smaller, more tactically mobile, and more lethal operational units.

US warfighters will increasingly rely on stealth, mobility, dispersion, and a higher battlespace operational tempo. This will require real-time gathering, processing, and distribution of information, at and among all levels/echelons, through the Global Information Grid (GIG) characterized as follows:

> The foundation of the framework to support such Battlespace characteristics is an information grid, which provides infrastructure and services that establish a supporting information environment. Grid capabilities fall into three general areas: distributed environment support, universal transaction services, and assurance of services. They provide warfighters and their systems the ability to exchange information and work collaboratively unimpeded by differences in connectivity, processing, or interface characteristics. The grid provides generic, robust services to support warfighters as they tailor their information environment to include local and remote organizations, people, and assets.[2]

## Spectrum Resources

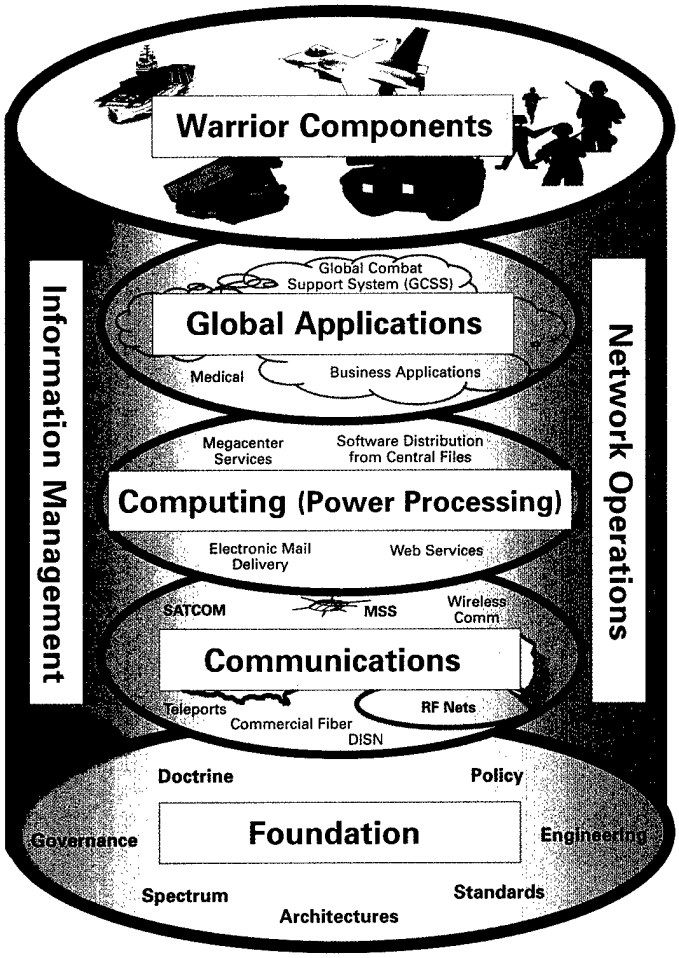
The electromagnetic spectrum is the only medium that can support the mobility, dispersion, and higher operational tempo envisioned in JV 2010. In order to "work collaboratively unimpeded by differences in connectivity, processing, or interface characteristics" (Reference 2), the GIG will employ a wide range of electromagnetic spectrum resources. Thus, the assured availability of spectrum to support military operations both today and well into the 21st century is vital.

[2] *ABIS Task Force Report Executive Summary*, Volume I, Director of Defense Research and Engineering and Director for Command, Control, Communications, and Computer Systems, May 1996.

# *Global Information Grid*

## *The GIG Vision*

- A single secure Grid providing seamless end-to-end capabilities to all warfighting, national security, and support users
- Supporting DoD and IC requirements from peacetime business support through all levels of conflict
- Joint, high capacity netted operations
- Fused with weapons systems
- Supporting strategic, operational, tactical, and base/post/camp/station levels
- "Plug and Play" interoperability
  - Guaranteed for US and Allied
  - Connectivity for Coalition users
- Tactical and functional fusion a reality
- Information/Bandwidth on demand
- Defense in Depth against all threats




**Protected, Assured, Interoperable Communications**

In addition to enabling the GIG, the electromagnetic spectrum will enable important, rapidly developing navigation, sensor, and weapons systems. Among these systems are revolutionary advances in radio navigation systems, position location systems, radar systems, telemetry systems, foliage penetration radar and communications systems, multi-spectral environmental systems, and directed energy weapons systems, each of which is dependent on unencumbered access to spectrum. Introducing these emerging systems in the battlespace environment will present a challenge to current DoD spectrum management practices and procedures, and the DoD must adapt to this challenge.

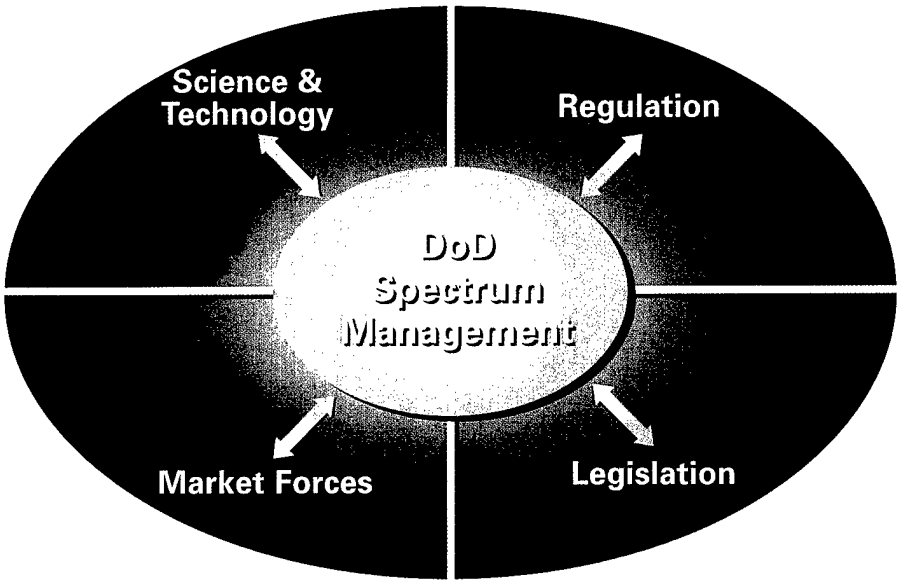
Implementing JV 2010 demands new spectrum management operational concepts, tactics, and doctrine as well as new technologies for effectively designing, producing, and operating the GIG. It also demands new strategies with respect to spectrum management policy at the national and international levels. In response to these demands, it is the goal of the DoD that all spectrum management organizations be actively engaged in reviewing their processes and business practices to ensure maximized spectrum access for the warfighter in support of JV 2010. To achieve this goal, the DoD intends to adopt a focused, coordinated management approach to the four major domains affecting the use of the electromagnetic spectrum: legislation, regulation, science and technology, and market forces.

## The Evolving Spectrum Management Domains

### Legislation

The legislative pressures to reallocate and auction additional portions of the electromagnetic spectrum, previously allocated exclusively to the Federal Government and used by DoD, to commercial interests will continue. In response to these legislative pressures, the DoD must continually be prepared to validate, justify, and defend its electromagnetic spectrum requirements. In addition to defending requirements and maintaining access to necessary spectrum resources, the DoD must implement strategies to make use of shared spectrum. Shared spectrum access will provide an avenue through which the DoD can simultaneously promote interoperability, efficiency, and protection; it will also enable the achievement of one of the premises of Information Superiority — support to military operations anywhere, anytime.

The DoD must work with international legislative bodies and with its international allies and potential coalition partners to ensure that electromagnetic spectrum requirements can be consistently met on a global basis on land, at sea, in the air, and in space. Within the US, the DoD must work with national legislative bodies and with other government and non-government spectrum users to provide assured, sufficient spectrum access for the US Armed Forces to meet national security requirements.




**Spectrum Management Domains**

## Regulation

The electromagnetic spectrum is a finite natural resource controlled within each nation as that nation's sovereign right. US forces may be required to operate within the sovereign boundaries of multiple nations on land, at sea, in the air, or in space and are subject to the regulatory controls of each of those nations. The International Telecommunication Union (ITU), an agency of the United Nations (UN), coordinates and sets international standards and regulations for use of the radio spectrum and allocates frequency bands for specific uses within different global regions. The US accords the ITU Radio Regulations treaty status. Within the US, the National Telecommunications and Information Administration (NTIA) regulates Federal Government use, and the Federal Communications Commission (FCC) regulates Non-Federal-Government use of the radio spectrum. The NTIA and the FCC coordinate national radio spectrum allocations and assign frequencies for Federal, Non-Federal, and shared use within the US. DoD users must follow and adhere to NTIA regulations nationally. ITU statutes and host nation unique regulations and allocations guide DoD spectrum use internationally.

The regulatory domain is experiencing rapid changes due to forces in the legislative, market, and technology domains. It is imperative that the evolution of regulations within the international environment moves forward as rapidly as the associated technological and market forces. The DoD must continually monitor the activities of regulatory bodies and proposed changes to regulations and respond where there is potential impact to the DoD.

## Science and Technology

Technologically superior equipment has been critical to past successes in combat, and US forces must continue to employ equipment that is engineered for superior mission performance, safety, and reliability. It is expected that the early 21st century will be a period of accelerating technological change, and the DoD must continually leverage technological improvements and advances into increased military capabilities. Many of these capabilities, such as global positioning systems, advanced multispectral sensors, anti-stealth radar, and advanced secure, high capacity communications, will increase the demand for electromagnetic spectrum needed to support Information Superiority.

In addition to increasing spectrum demand, the manner in which the electromagnetic spectrum is accessed is being changed by technological advances. Digital communications networking methods permit bundling of voice, video, and data services into seamless information infrastructures. Advanced digital modulation techniques promise increased spectral efficiencies. Spectrum access methods developed for commercial digital radios support operating principles that apply to the concept of shared electromagnetic spectrum access. As a consequence of these trends, technological efforts must be fostered to gain more capacity from given amounts of spectrum as well as permit effective sharing of the spectrum by diverse DoD, civil, and commercial systems. The DoD must encourage and support the development and adoption of universal equipment standards that will facilitate the implementation of shared access technologies.

## Market Forces

The growth of commercial sector uses for the electromagnetic spectrum, driven in part by the explosion in information technology, is dramatically increasing and is expected to continue to increase worldwide well into the 21st century. The economic importance of spectrum to commercial users is a reality on a global basis. In the US, economics has contributed to the Federal Government's decision to auction spectrum licenses for some frequency bands previously allocated exclusively to the Federal Government and used extensively by the DoD. Internationally, other countries have conducted auctions, and commercial interests are pursuing the use of frequencies or sharing of frequencies currently used by critical US military systems. The DoD must recognize and consider the importance of market forces when formulating its electromagnetic spectrum strategy. In addition, the DoD must seek opportunities to leverage commercial spectrum related developments to its advantage.

## A National Spectrum Plan

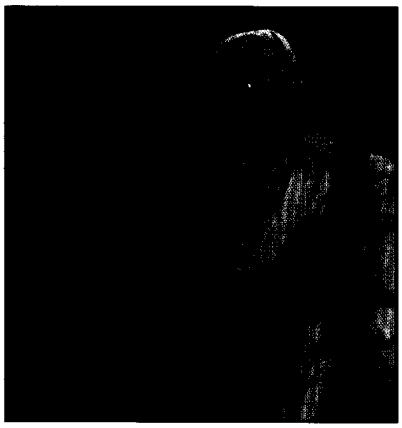
The DoD will press for and support the development of a National Spectrum Plan. The purpose of such a plan is to establish and protect national spectrum priorities, promote spectrum sharing among all users, and provide a plan of action for transitioning from the present environment of segregated spectrum use to one of increasing compatibility, interoperability, and sharing.

The National Spectrum Plan must recognize the global as well as the national regulatory, technological, and market forces driving changes in the use of the electromagnetic spectrum. It must promote the development of win-win strategies and policies where shared access to spectrum will introduce efficiency and economy to the DoD acquisition and operation of spectrum-dependent information and weapons systems, benefit industry, and promote national and international interoperability. The plan must be founded on sound business case analysis and a critical review and understanding of both DoD operational requirements and commercial business practices and trends.

## The Joint Spectrum Management Team

A highly qualified, well-trained, dedicated and motivated team of professional DoD spectrum management personnel will be the key to ensuring that sufficient electromagnetic spectrum is available to enable US Armed Forces to realize JSV 2010. The DoD must continue the development and evolution of spectrum management career paths and training programs at all skill and organizational levels. As DoD moves into the 21st century, the role of a spectrum manager will undergo major changes in response to the pressures of new technologies and their influence on DoD operations. In an era of accelerating spectrum demand and rapid technological change, the quality of spectrum management personnel will be critical to ensuring that warfighter electromagnetic spectrum needs are met. The DoD must empower spectrum management organizations so that limited personnel resources can be employed most effectively. The interchange of information within the DoD spectrum management community, as well as with other government agencies, commercial interests, coalition partners, and allies and host nations will be essential.

# Implementing Joint Spectrum Vision 2010



**Information to the Warfighter**

Timely implementation of advanced battle space information systems requires broad participation in a new way of doing business: continual assimilation and utilization of advanced information technology; concurrent advances in force employment, and command and control concepts; increased focus and coordination within the operational, doctrine and training, science and technology, and acquisition and O&M communities; a process that emphasizes the coordination of planning, architecture, and a collaborative integration and evaluation environment, with rapid incorporation into system acquisition, O&M and training programs. (Reference 2)

JSV 2010 must be implemented to ensure that present and future DoD electromagnetic spectrum needs are met. The DoD's spectrum strategy must protect against and minimize encroachment on its access to the electromagnetic spectrum, while preserving and maximizing operational effectiveness. Toward this end, spectrum management as a business practice must adopt guiding principles for the future that will support the achievement of Information Superiority by the US Armed Forces. These guiding principles are

- Participate in cooperative engagement with the acquisition, operational, and support communities to help enforce spectrum management requirements at the earliest stages of new technology developments, as well as throughout the life cycles of spectrum dependent systems
- Participate in active engagement with the regulatory and legislative communities to address spectrum access issues in the role of a leader and innovator, as well as the traditional role of defender of spectrum needs
- Adopt the view that spectrum management and the acquisition of spectrum dependent assets are business practices. Use market analysis and the evaluation of economic implications in decisions affecting the spectrum
- Build upon and leverage the power of modeling and simulation

Our organizational climate must reward critical thinking, foster the competition of ideas, and reduce structural or cultural barriers to innovation. (Reference 1)

The DoD must develop and maintain a long-range spectrum management strategic plan that will provide its Joint Spectrum Management Team with policy guidance, management focus, and technical direction. The strategic plan will be a critical link to ensuring that US forces have adequate electromagnetic spectrum access in support of the objectives of JV 2010.

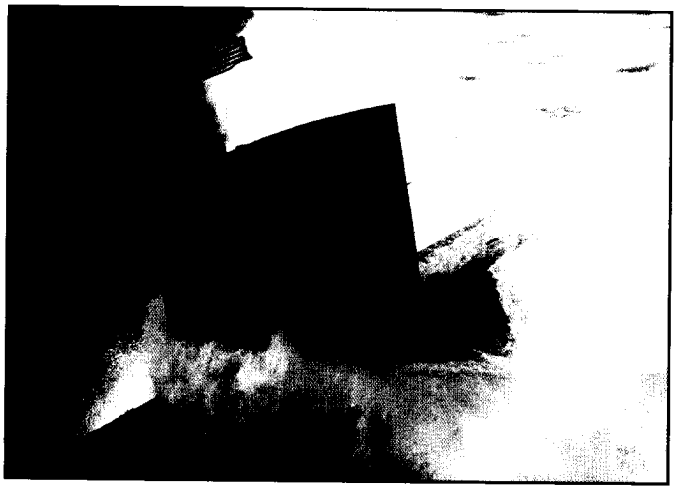
As the DoD implements JSV 2010, it must ensure that spectrum management fully supports the evolving warfighting doctrine guided by JV 2010. The spectrum management community at every level must assess spectrum management support to military operations and implement changes necessary to ensure support of both current joint doctrine and future joint warfighting concepts.

It is also critical that the spectrum management community use every opportunity to make commanders and forces aware that the electromagnetic environment is a key element of the overall joint warfighting battlespace. The electromagnetic realm of the battlespace includes hostile spectrum use, hostile as well as friendly electronic warfare, and friendly, neutral, and host nation spectrum use. In support of spectrum awareness, commanders must be educated on the reality that the proper employment of spectrum is a combat multiplier. Since spectrum use is critical to almost every battlefield function, operational forces must be educated and trained on how to employ spectrum efficiently, achieving full weapons system effectiveness while preventing electromagnetic fratricide (interference to friendly forces).

An important function of the Joint Spectrum Management Team will be the assessment and recommendation of new technologies that will allow the increased efficiency of spectrum use needed to ensure US Armed Forces Information Superiority. These new technologies must be subjected to the appropriate tradeoffs needed to provide the warfighter with the best balance of capability, interoperability, and cost.

## Conclusion

The US Armed Forces are poised to actualize the concepts outlined in JV 2010. In order to meet the JV 2010 21st century vision of Full Spectrum Dominance, it is critical that US forces achieve Information Superiority over all potential adversaries. The electromagnetic spectrum is the only medium that can support Information Superiority and the mobility, dispersion, and higher operational tempo envisioned in JV 2010. Thus, the provision of assured, adequate spectrum access for US Armed Forces is critical to supporting JV 2010. To this end, JSV 2010 provides the conceptual framework to achieve assured electromagnetic spectrum access for US Armed Forces. The key to success is a highly motivated and skilled spectrum management team. Together we will overcome the challenges, technological and otherwise, necessary to ensure that our Armed Forces have access to sufficient electromagnetic spectrum resources to be "persuasive in peace, decisive in war, and preeminent in any form of conflict." (Reference 1)



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